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the inferior to be $1-(\frac{9}{11})^n$. The answer is, therefore, $(\frac{9}{11})^n+\frac{3}{4}[1-(\frac{9}{11})^n]=\frac{3}{4}+\frac{1}{4}(\frac{9}{11})^n$ dollars.

II. Solution by A. L, FOOTE, C. E., Merrick, New York.

Let $a=$($1.) price of better kind, and $b=$(75cts.) price of the inferior kind per lb. Then, the value of 1lb. after first mixture is, $a(\frac{9}{11})+b(\frac{2}{11})$; after the second, $[a(\frac{9}{11})+b(\frac{2}{11})]\frac{9}{11}+b(\frac{2}{11})=a(\frac{9}{11})^2+b(\frac{2}{11})(\frac{9}{11}+1)$; after the third, $a(\frac{9}{11})^3+\frac{2b}{11}[(\frac{9}{11})^2+(\frac{9}{11})+1]$, etc., etc.; and after the nth mixture, $a\,(\frac{9}{11})^n+\frac{2b}{11}[(\frac{9}{11})^{n-1}+(\frac{9}{11})^{n-2}+\ldots.+1]$.

The sum of the series of which $\frac{2b}{11}$ is a factor is $b-b(\frac{9}{11})^n$, and the entire value is $b+(\frac{9}{11})^n(a-b)=\frac{3}{4}+\frac{1}{4}\,(\frac{9}{11})^n$ dollars.

III. Solution by the PROPOSER.

By Finite Differences. Let $f(x)$ be the price per lb. of the xth mixture, then $\frac{9}{11}f(x)+\frac{2}{11}\times 75$ will be the price for the $(x+1)^{th}$. $\therefore f(x+1)=\frac{9}{11}f(x)+\frac{150}{11}$. Solving we get, $f(x)=75+C(\frac{9}{11})^x$. For $x=0$, $f(x)=100$, $\therefore$ 25, and $f(x)=75+25\,(\frac{9}{11})^x$, [or as above $\frac{3}{4}+\frac{1}{4}\,(\frac{9}{11})^n$ dollars.]

Also solved by *J. H. DRUMMOND, J. K. ELLWOOD, F. P. MATZ.* and *G. B. M. ZERR.*

22. Proposed by F. P. MATZ, M. A., M. Sc., Ph. D., Editor of the Department of Mathematics in the "New England Journal of Education" and Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

For the sum $D=\$30$, Messrs. Zerr and Ellwood contracted to plough the sod for a circular track, width, $m=60$ feet and inner radius $r=940$ feet. How is the money to be divided, if they commence ploughing at the inner circumference of the track, make uniform furrows of width $n=1\frac{1}{3}$ feet, and Mr. Ellwood continually follows Mr. Zerr during the ploughing?

Solution by J. K. ELLWOOD, A. M., Pittsburg, Pennsylvania; M. A. GRUBER, A. M., Washington, D. C.; A. H. BELL, Hillsboro, Illinois; J. H. DRUMMOND, LL. D., Portland, Maine; and P. S. BERG, Apple Creek, Ohio.

$\frac{m}{n}=\frac{60}{1\frac{1}{3}}=45$ rounds; as Mr. Zerr begins, he plows 23 furrows and Mr. Ellwood 22 furrows.

Now, $\pi\,(r+n)^2-\pi n^2=\pi n(2r+n)$, the surface of Z's 1st furrow.

His next furrow is represented by $\pi\,(r+3n)^2-\pi(r+2n)^2=\pi n(2r+5n)$, and so on, each furrow having just $4\pi n^2$ more surface than the next preceding. Hence, we have an arithmetical progression, whose first term is $\pi n(2r+n)$, com. diff. $4\pi n^2$, and number of terms 23. $\therefore$ The area of Z's rounds is $\pi(r+n)^2-\pi r^2+\pi(r+3n)^2-\pi(r+2n)^2+\ldots.+\pi(r+45n)^2-\pi(r+44n)^2$, or $\pi n(2r+n)+\pi n(2r+5n)+\pi n(2r+9n)+\ldots+\pi n(2r+89n)$, or $23\pi n(2r+45n)$.

Evidently, the area of E's rounds is $\pi(r+2n)^2-\pi(r+n)^2+\pi(r+4n)^2-\pi(r+3n)^2+\ldots.+\pi(r+44n)^2-\pi(r+43n)^2$, or $\pi n(2r+3n)+\pi n(2r+7n)+\pi n(2r+11n)+\ldots.+\pi n(2r+87n)$, or $22\pi n(2r+45n)$.

Hence, Z's portion of $D=\$30$: E's portion $=23\pi n(2r+45n):22\pi n(2r+45n),=23:22$.

$\therefore$ Zerr gets $\frac{23}{45}D=\frac{23}{45}$ of \$30=\$$15\frac{1}{3}$, and Ellwood gets $\frac{22}{45}D=\frac{22}{45}$ of \$30=\$$14\frac{2}{3}$.

Also solved by Professors *MATZ*, *PHILBRICK*, and *ZERR*.

NOTE:—H. W. Draughon remarks of Professor Zerr's solution of prob. 9, that the method fails unless the original equations are factored as in (1), (2), and (3) of solution; that they can not be so factored unless the values of x, y, and z are known; and if these values are known, there is no need of solving. A similar comment has been received from Professor M. C. Stevens.

PROBLEMS.

29. Suggested by MANSFIELD MERRIMAN, C. E., Ph. D., Professor of Civil Engineering, Lehigh University, South Bethelehem, Pennsylvania.

Solve neatly the equations: $\dfrac{y(1+x^2)}{x(1+y^2)}=a\dots(1)$, and $\dfrac{y^4(1+x^8)}{x^4(1+y^8)}=b..(2)$.

30. Proposed by C. A. ROBERTS, Long Bottom, Ohio.

Find the sum of $n=10$ terms of the series $1+15+55+134+265\dots$.

31. Proposed by D. G. DORRANCE, Jr., Camden, Oneida County, New York.

Sum the series 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, etc. to n terms. Also what is the nth term?

32. Proposed by LEV. WEINER, Professor of Modern Languages, Missouri State University, Columbia, Missouri.

Find a number consisting of 6 digits which when multipled by the first 6 natural numbers gives the same digits in rotation.

33. Proposed by C. E. WHITE, Trafalgar, Indiana.

Show that every algebraic equation of the nth degree, n being greater than two, which is complete in its terms may be transposed into an infinite number of equations which want their second term.

Solutions to these problems should be received on or before November 1st.

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GEOMETRY.

Conducted by B.F.FINKEL, Kidder, Missouri. All Contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

14. Proposed by HENRY HEATON, M. S., Atlantic City, Iowa.

Through a given point to draw four circles tangent to two given circles.